Future Technology Vision: City of Access

A firm IT foundation is essential to achieving the administration's strategic objectives and action plans. The need for IT support is most obvious in the area of making government work. Today, electronic services and elaborate electronic record-keeping are necessary to meet the most basic expectations of government's customers. Fulfilling the Mayor's other four objectives also demands robust IT support. Many agencies are involved in delivering services to children, youth and families. We must have comprehensive, integrated databases to assure that these services are coordinated and complete. Healthy neighborhoods require round-the-clock public safety services, which depend on up-to-date communication, computing, and mapping systems. Economic development requires sophisticated citywide IT data access and communications infrastructures. Today, businesses will not locate in any city that lacks telephone, cable, broadcast, wireless and Internet communications, generally at T1 speeds; electronic delivery of government information and services; a local workforce that is technologically sophisticated and Internet-savvy; and a government that consistently uses best practice technology. Finally, to unite groups and individuals behind a common agenda, we must make information resources equally accessible to all residents.

> *"Our goal is to make the District a city of access. We want to give every resident, every business, and every government employee the technological keys to the city."*
>
> *Suzanne J. Peck*
> *Chief Technology Officer*
> *District of Columbia*

Our IT vision is to meet the administration's strategic objectives and our agencies' needs by transforming the District into a city of access. A city of access is one where *all government business processes work*, where government systems function reliably and efficiently, and where we match private industry in the urgency and quality with which we deliver services. When all government business processes work:

- residents, businesses and visitors can do business with the District government at any time and any place by phone, Internet, or community kiosk, as well as from government offices;

- District computing and telecommunications networks feature proven technologies and comprehensive security protections;

- every District government location is connected to the government network, and all connections are secure, fast and reliable;

- the District minimizes cost and maximizes computing values through non-proprietary, open systems technologies;

- all District employees have access to email and administrative software;

- each major agency has a Chief Information Officer (CIO) and IT capital and operating budgets adequate for mission-critical projects;

- compensation for IT staff and program managers is competitive;

- IT staff are sufficient and competent to implement and operate all city systems;

- District managers, not consultants, are the principal repositories of District systems expertise; and

- all agencies are able to define problems in non-technical terms and use technology to help solve them. Technology is a tool, not a solution.

Once all government business processes work, we'll use technology as a strategic enabler to build our economy, engage our residents in civic decisions, and enhance regional cooperation. We'll deploy technology strategically to attract people, businesses and jobs. We'll build strong public-private partnerships with businesses, non-profits, universities and residents to address community problems that government alone cannot solve. The District will share technologies with our neighboring jurisdictions to leverage the city's strengths across political boundaries and position the District as the hub of the metropolitan region.

IT Environment and IT Transformation Needs

In developing a blueprint for transforming the District into a city of access, we began with an understanding of where we were.

In 1999, during our collaboration with District agencies to achieve Y2K compliance, we conducted a citywide evaluation of District IT funding, budgeting, management and infrastructure. During the next two years we surveyed all 68 District agencies and interviewed managers at 23 mission-critical agencies to identify agency-specific IT infrastructure and IT application needs. These are shown at a glance in Exhibit 3.

We found both significant strengths and compelling needs. As a result of the Y2K effort, agencies had acquired new IT expertise and embraced a new performance-based technology culture. But at the same time, a decade and a half of underinvestment in IT had left the District with critical requirements in IT budgeting, management, staffing, infrastructure, and service delivery/information management applications.

Exhibit 3: Survey of Agency IT Needs

	Infrastructure					Applications — Retail (External)			Applications — Wholesale (Internal)									Management		Agency	Group
	Connectivity: DC WAN, DC I-Net, Citywide Wireless Communications, Telecommunications	Consolidated Data Center Management	Citywide Wireless Data Networks	Seat Management	UCC: Help Desk/NOC	E-government (including email)	UCC: Call Center, 911, 311, Emergency Command Center Applications	Public Service Workstation Applications	Workflow Management Systems	Agency Applications	Call Center Applications	EIS (Data Warehouses)	GIS Applications	Property Management System	ERP: Personnel/Payroll	ERP: Procurement	ERP: Financial Mgt. System (including Budget)	IT Management (IT Investment Management/Training)	BPR (Business Process Re-engineering)		
	✓	✓	✓	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓	✓	DCOP	Operations
	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	DMV	
	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	DPW	
	✓	✓	✓	✓	✓	✓				✓	✓	✓		✓	✓	✓	✓	✓	✓	OCP	
	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	OCTO	
	✓	✓	✓	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓	✓	OPM	
	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	DDOT	
	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	DCRA	Economic Develop.
	✓	✓	✓	✓	✓	✓		✓		✓	✓			✓	✓	✓	✓	✓	✓	DOES	
	✓	✓	✓	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓	✓	DCPS	Children and Families
	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	DCPL	
	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	DHS	
	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	DOH	
	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	DPR	
	✓	✓	✓	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓	✓	UDC	
	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	DOC	Public Safety
	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	EMA	
	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	FEMS	
	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	MPD	
	✓	✓	✓	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	CMHS	Independent Agencies
	✓	✓	✓	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓	✓	DC LOT	
	✓	✓	✓	✓	✓	✓				✓	✓	✓		✓	✓	✓	✓	✓	✓	OCFO	
	✓	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓	✓	✓	✓	✓	WASA	

Many citywide IT needs, particularly those in the foundation areas of IT budgeting, management and infrastructure, were so urgent that we addressed them immediately. We launched key budget, management, and infrastructure programs in 1999, and urgent information service applications in 1999-2000. Today, most of these programs are complete, and the District's IT environment is already dramatically different from the one we found in early 1999. Consequently, the picture of the District's environment is a double image: the 1999 historical environment that shaped our earliest transformational programs, and the environment of 2002 that reflects the completion of those programs and the shaping of more advanced programs we've launched recently. Our discussion focuses on four key elements of our IT environment: funding and budgeting needs; management and staffing needs; infrastructure needs; and service delivery/infrastructure management applications needs.

IT Funding and Budgeting Needs

At the start of our plan horizon in early 1999, the District's IT funding need was simple: to reverse a decade and a half of technology disinvestments in our city. Lacking a commitment to citywide IT investment, the District had fallen far behind the times. Business processes that had long been automated in private industry and major municipalities were still manual in

agencies across the District. The average age of a computer application was nearly a decade. The city's data center hardware dated back to the disco era. There wasn't a single modern, digital unit among the District's 30,000 phones, and 8,000 phones were rotary models rarely seen outside museums.

Without significant IT funding, the District lacked systematic IT budgeting processes or IT budgeting expertise. Even though major projects required multi-year plan, design and install cycles, there was no multi-year IT budgeting. Few agencies had multi-year IT capital or operating budgets. Agencies which did launch IT projects did so without planning and budgeting for full project lifecycles. Without life-cycle budgeting, agencies were unable to undertake consistently rational and cost-effective IT acquisitions.

Nor was there any centralized or coordinated IT budgeting process. Agencies rarely coordinated their IT budgets, even though many needed similar or identical IT capabilities. The District had implemented many redundant and incompatible technologies. The District also lacked centralized, coordinated IT procurement capabilities and had no volume IT purchase agreements in place. Procurement contract periods averaged 120-125 days, making it nearly impossible to provide seamless delivery of services and supplies.

As of January 2002, the District's IT funding and budgeting picture is dramatically different. Three years ago, the Mayor, the District Council and the Congress committed to reversing the IT disinvestments of the past. To ensure that our new investment yields the highest possible return, we've completed several of the foundation IT programs discussed in *IT Transformation Goals and Programs* below. We have a centralized IT budgeting process that coordinates and prioritizes major IT projects and ensures they meet proven success criteria before they're approved. We have a centralized IT procurement process to eliminate inter-agency redundancies and maximize the District's buying power. We support these processes with a project management system that allows us to track the progress of each project, identify emerging problems, and solve them expeditiously.

IT Management and Staffing Needs

The single greatest obstacle confronting the District in IT—both historically and currently—is IT understaffing and lack of IT management.

The District's long under-investment in IT left the city at the turn of the 21st century with a significant citywide deficit of IT management expertise. The city's reputation for IT disinvestments made it extraordinarily hard to recruit sophisticated IT professionals. Even when the administration launched its strategic initiatives in late 1999, District agencies had too few experienced IT executives, project managers and functional experts to initiate new IT projects or manage existing systems. The administration's objectives, which call for broader and more efficient city services as

well as electronic service delivery, have multiplied our needs for competent IT professionals. Yet many agencies still lack Chief Information Officers (CIOs). Many need additional IT staff to fill gaps in critical IT skills.

IT understaffing not only compromises city services, it reduces efficiency and increases IT systems costs. Understaffing limits our ability to maintain current systems. As a result, we experience extended maintenance downtimes, and our systems are thus underutilized. Understaffing delays and even blocks the implementation of new IT systems because sponsoring agencies lack adequate IT staff to manage and maintain them. Worst of all, understaffing multiplies personnel costs by forcing agencies to fill their most urgent IT needs with consultants. We're paying substantial salary premiums for consultants with IT experience, but the benefits of these costly services are often short-lived. While they're here, consultants develop extensive expertise in District IT systems, but we lose that expertise when they leave, and we pay to replace the experience again and again. Without CIOs and senior IT managers, many agencies find it hard to recruit other IT personnel because they're unable to define the IT positions they need to fill. Agencies also face marketplace and District-specific obstacles to attracting qualified IT candidates.

The principal causes of IT understaffing in the District are problems in recruitment, retention, and training. Despite the collapse of the tech bubble, sellers still rule in the IT talent market. According to the Bureau of Labor Statistics, demand for computer scientists, computer engineers, systems analysts, electronic data processing personnel, and database administrators is expected to grow at least twice as much as demand for any other position requiring a college degree, and more than demand for any other IT industry position, during the decade 1998-2008. As a result, the District faces fierce competition for IT staff. Private industry recruiters attract IT professionals with high salaries and with a growing menu of perquisites such as stock options, sign-on bonuses, additional paid days off, trips, movies, theater, and sports tickets, free reserved parking, computers/laptops for personal use, leased cars, and even paid vacation on their birthdays. Competing with the generous pay and perquisites of the private sector presents a major ongoing challenge for the District government.

In addition, the District's hiring cycle is much longer than hiring cycles in private industry. Because the District's 40-year-old pay classification system doesn't meet IT market rates, we make time-consuming adjustments for every IT position in order to offer competitive compensation. Once we make candidate decisions, candidates wait six to eight weeks to receive formal offer letters, as compared to just one to three days in the private sector. Highly sought-after IT professionals don't wait that long. As a result, we're losing some of our best candidates to industry competition, even after they've agreed to accept District jobs.

Numerous District IT positions are classified as Excepted Service and are subject to District residency requirements. Many desirable IT candidates live in suburban jurisdictions, and are unwilling to move to the District, where they face higher income taxes and sacrifice representation in Congress.

Our IT reputation still reflects the IT disinvestments of the 1990s, not the ambitious IT vision of today's Mayor and District Council. Advertising alone can't erase the negative image and attract top talent overnight.

The District has several strengths, however, that can help overcome these recruitment obstacles. Because we're building a complex, state-of-the-art IT infrastructure from the ground up, our IT positions offer greater opportunity for challenge and creativity than many in the private sector. Our positions also offer unusual collegiality with non-IT colleagues, who share a common excitement about the city's renaissance and welcome the IT solutions we're creating. Location is an advantage. For some, District positions are highly Metro-accessible, offering candidates more commuting options than many suburban employers can. Our jobs are located in the heart of a vibrant city filled with recreational and cultural attractions.

Overall, the District's IT recruitment and retention picture contains a mix of good news and bad news. While we fall behind our competitors in reputation and compensation, we have strong advantages in location and job challenge. Today, we're deploying these strengths as part of an aggressive campaign to overcome our recruitment deficits and fill the District's open IT positions.

Significant training needs also contribute to the District's IT understaffing problems. District agencies are grappling with two types of training needs. First, agencies need better training for non-IT personnel in using IT applications. Agency managers observe that many existing system capabilities go unused because agency staff lack the training needed to fully utilize system capabilities. User training needs are especially urgent in customer service applications, where employees must master both systems and information content to answer questions and deliver city services.

Second, District agencies need training to help fill numerous gaps in IT skills. Many agencies lack important IT management skills, such as business analysis, project management, and package application implementation experience. Others lack focused technical skills such as database design and administration, network operations, legacy systems expertise, and web page design and maintenance.

Inadequate training also compromises our ability to retain the staff we have. Without training to keep their skills current, some of our IT professionals become frustrated and seek employment in organizations that recognize their value by making regular training a high priority.

IT Infrastructure Needs

In early 1999, the start of our plan horizon, the District's most immediate IT infrastructure need was to modernize basic IT and communications equipment—our 100% non-digital and 25% rotary phones, decade-old applications software, and 25-35-year-old mainframes. Beyond this basic need, our most compelling IT infrastructure needs were capabilities to coordinate agency functions, share and consolidate accurate data, and communicate across agency boundaries. At that time, the District had a total of 370 separate systems. With the exception of our financial system, each was a single-agency system incapable of communicating or coordinating with any other. The District had eight separate data centers, all operating on antiquated hardware platforms, with none able to integrate functions or exchange data. Communication systems were equally primitive. All data communications were local, with only modest local area network (LAN) components. The city had no wide area network (WAN) to permit communication between and among agencies. From a data access and communications perspective, each agency was virtually an island.

Because of these dramatic problems in coordination and communication, there were both gaps and overlaps among agencies in numerous specific IT infrastructure capabilities, including resource management, case management, data marts, geographic information systems, PC workstation management, and others. The District was duplicating processing functions and processing costs in multiple agencies. We suffered from inaccurate data and poor decision-making as successive personnel from multiple agencies updated separate databases on different update cycles. Resident services were slower than necessary as city employees drew on separate data sources and collated information manually to respond to even simple requests. Without centralized systems operations and maintenance, we had incomplete, inconsistent security protections and recurrent reliability problems.

The District's infrastructure looks very different today. We've modernized the city's hardware, software and communications equipment. We have broad-bandwidth LANs in agencies throughout the city, as well as an all-agency WAN. Through centralized operation and maintenance of citywide and multi-agency systems, we've assured that our systems are consistent, reliable and protected from interruption and intrusion by a multi-layered, comprehensive security system. We're nearing completion of major infrastructure projects to consolidate data processing and storage, to integrate functions across agencies, and to create citywide communications and computing networks.

As a result, the infrastructure needs that agencies identify today call for higher-order capabilities. Among the most widely requested infrastructure program is a call center to handle emergency and non-emergency resident service and information requests, a centralized help desk to assist city employees with systems performance and computing problems, security enhancements to ensure adequate protection as agencies

expand access to information and services through the Internet, seat management (centralized management of PC workstations), geographic information systems (GIS) to provide sophisticated mapping capabilities for numerous agency uses, and expanded wireless services to support mobile computing and communications. Another key infrastructure request is for a robust web-based infrastructure to support electronic service delivery and to give agencies the tools to develop their own websites and web-based applications.

Service Delivery and Information Management Needs

In 1999, the District's most fundamental application need was to update the decade-old applications we did have and create new ones to automate previously manual processes. We've modernized many pre-existing applications, automated basic business processes, and developed a citywide web portal. The District's IT applications needs are now much more sophisticated. The most widespread need is enterprise resource planning (ERP) to integrate citywide the back-office systems all agencies use—finance, human resources, procurement, payroll, property management, and performance budgeting—so that agencies can share administrative resources and eliminate administrative redundancies.

In addition, many or all agencies want specific applications to help them manage data and improve the quality and efficiency of their mission-specific services. All agencies need tools for developing or refining web pages and web-based applications to support internal agency processes and to deliver resident and business services electronically. Many agencies want electronic document management, integrated case management, and various business information systems, such as data warehouses, to enhance executive decision-making and case tracking. Groups of agencies that serve the same populations or functions—such as children, public safety, and public health—want applications that permit them to integrate functions, exchange case information, and share common databases. Numerous agencies want innovative applications that integrate new technologies into their business processes to increase the efficiency and quality of their services. The city as a whole needs sophisticated technology programs to expand access to technology for all residents and businesses and to support economic development.

As with infrastructure, many of these agency application needs are common to most or multiple agencies. Accordingly, we're meeting them with integrated citywide projects.

IT Transformation Principles and Drivers

Principles are arguable propositions designed to guide decision-making. We chose seven operating principles to guide the District's IT transformation and ensure that our new investment in IT yields the greatest possible return. These principles reflect the District's IT budget and personnel resources, industry best practices, technology market trends, and common sense. Three of the principles are organizational in nature, one each is legal and financial, and two are technical.

Organizational Principles

1. Build an integrated technology culture, based on a federative model, to manage the DC information technology strategy.

2. Build a strong IT personnel corps in the agencies and in OCTO.

3. Promote a strong program management function in the agencies.

Legal and Financial Principles

4. Meet and anticipate legal requirements.

5. Centralize planning and goal setting of IT funding.

Technical Principles

6. Provide systematic support for District processes.

7. Select and implement technologies using proven IT best practices.

Organizational Principles

1. Build an Integrated Technology Culture

District agencies are expert in their functional missions and services, while OCTO is the District's expert in IT. To make the best use of agency and OCTO expertise, we've chosen a federative model similar to the federative model of the United States. In our federative IT model, OCTO collaborates with District agencies in a three-tiered system.

- OCTO maintains centralized responsibility for IT budgeting, acquisitions, data and architecture standards, IT best practices, IT research, and the development of citywide IT infrastructure and applications.

- Multi-agency consortia, with one agency exercising project leadership and OCTO supplying oversight, manage citywide and multi-agency IT applications.

- Individual agencies manage applications that are specific to their missions, with OCTO providing oversight, technical standards, and assistance upon request.

Through our ongoing collaboration in this federative model, agencies and OCTO are building the performance-based technology culture we need to manage robust and sophisticated District IT solutions.

2. Build a Strong IT Personnel Corps

The IT federative model, in which single agencies or agency consortia manage IT applications, demands a corps of able IT professionals in the agencies and in OCTO. Marketplace demand for top IT professionals, when linked to the District's budget realities, means that the District must acquire its IT corps deliberately. We must grow District IT staff incrementally, retaining and continually training the IT personnel we already have while pursuing new IT talent aggressively through a variety of recruitment initiatives.

3. Promote Strong Program Management

IT program management is the management of personnel, budget, technology and time to produce outstanding IT results. Strong program management is essential to ensure that IT programs meet user requirements, implementation schedules, and budgets.

As we grow our IT personnel corps with new hires, the District acquires program management skills readymade. Concurrently, OCTO and agencies must work together to provide thorough program management training for our current IT professionals. Our immediate goal is to achieve significant measures of citywide program management proficiency: a high proportion of IT program managers who hold the IT Project Management Institute's (PMI) Program Management Proficiency certification; all agency CIOs holding OCTO CIO certification; a substantial percentage of IT projects proceeding under formal program management; and a majority of projects monitored by the Project Office Executive Tracking System (POETS), whose program management tools reflect the PMI's guidelines for effective IT program management. Our longer-term goal is to build a strong cadre of District IT program managers who can manage IT projects effectively throughout project lifecycles and who can serve as the District's IT archival history and IT knowledge base.

Legal and Financial Principles

4. Comply with Legal Requirements

The legal requirements that affect OCTO most directly come from the 1998 law that created OCTO and defined its responsibilities. The Budget Support Act (DC Law 12-175, Act 12-399) directs OCTO to serve as a centralized IT resource for the District. Under the law, OCTO must exercise centralized responsibility for IT budgeting, acquisitions, best practices development, IT resources, IT architecture and data standards, and the development of citywide IT infrastructure and applications.

In addition, OCTO and agencies must meet and anticipate legal requirements relating to the ownership of intellectual property and the privacy of personal data. We must observe the intellectual property protections established by patent, copyright and trademark laws. We must also meet applicable requirements of new laws that protect consumers from misuse of private information in electronic transactions and information services. For example, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) has established stringent privacy safeguards for all personal health care data that is stored or transmitted electronically. We can expect similar protections for financial and other data in the future.

The District's IT programs must also recognize District and federal laws that mandate equal access to public services for persons with disabilities. The District's human rights law, DC Law 1-2501, and the federal Americans with Disabilities Act of 1990 (ADA) guarantee disabled persons equal access to most commercial and public services. The ADA applies to web information and services, and courts have held that state and local governments have an affirmative duty to provide access to Internet services for the disabled. The District is committed to providing equal access to our web-based services, and we've followed this principle by developing a 13-point program to make all District web applications accessible for individuals with disabilities.

5. Centralize IT Funding Oversight

IT programs require not only capital funds for hardware and software, but also operating funds to cover systems' post-implementation maintenance. Most IT project lifecycles extend for two or more years. District budget realities mean that we can't launch all promising IT projects simultaneously. For these reasons, District funding of IT must be a centralized, multi-year process that prioritizes projects based on proven standards for success. These standards are:

- the project must directly advance the agency's core mission. Mission-critical (as opposed to mission-important and mission-enhancing) projects must be implemented first;

- the project must be best practice—proven successful in other jurisdictions;

- a full planning cycle must have been completed prior to implementation. The project's budget plan must cover capital and operating costs for the entire project lifecycle;

- the project must have a supporting business case with 60-day deliverables tied to the spending plan;

- the receiving organization must be ready for the IT change. The project must be led by District personnel with the necessary program management and IT skills to implement and maintain the system successfully.

Technical Principles

6. Provide Systematic IT Support for the District

The technologies OCTO selects to support District business processes must be workable for the District—available, reliable, maintainable, interoperable, versatile, and broadly accepted by technical and non-technical users. Major technologies we've identified as workable for the District include:

- web-based technologies

- business intelligence systems

- hardware and systems software that are open, web-adaptable, and configured for clustered networks

- integrated computing environments

- accessible, secure communications

Web-based Technologies

Online information delivery is central to the District's strategic priorities and agency action plans. Web-based technology is familiar and comfortable for most DC residents, businesses and visitors because of its growing presence in our business and personal lives. Web-based systems are relatively easy for users to learn and manipulate. Creative use of web technology cuts application development cycles and dramatically raises government service levels. For these reasons, OCTO and District agencies are committed to using web-based technologies wherever possible to develop information and service applications. Our development approach is Microsoft-centric, i.e. focused on Windows servers and client processors. Microsoft/Windows technologies are widely used and well understood by residents and employees within and beyond the District. As a result, development expertise and resources are readily available and reasonably priced, and once we install new applications, users can master them quickly. In addition, because most agencies already have Microsoft platforms, a Microsoft-centric approach leverages existing resources, minimizing application development and maintenance costs.

Business Intelligence Systems

Business intelligence systems, such as decision support systems, executive information systems (EIS), and data warehousing repositories, are systems and data banks that combine and mine data from widely scattered sources to create new decision-making tools. District agencies have substantial needs, recently accentuated by the administration's strategic priorities, to share and combine data and coordinate service delivery. Business intelligence systems address these needs. They allow agencies to draw on multiple sources for performance analysis and service tracking, consult more comprehensive data sets to make better decisions, improve program planning through more thorough program evaluation, and ultimately deliver better services citywide. For example, business intelligence systems can be used to integrate data from the public schools, police, health and recreation departments, and other agencies to better design and manage programs for our children. Similarly, business intelligence systems can integrate data from separate law enforcement agencies to improve public safety and the administration of justice. OCTO will design and implement business intelligence systems to enhance these and other high-impact District services.

Hardware and Systems Software

Hardware and software configurations that are most workable for the District—most available, reliable, maintainable, versatile, and user-friendly—reflect three major IT trends:

- open systems and architecture

- the ability to support web-based applications

- configuration in network server clusters

Open systems feature publicly available architectures, multiple vendor sources, wide marketplace acceptance, and industry-established standards for interfaces and functionality. They are reliable, versatile and relatively cheaper to maintain than closed, proprietary systems. One well-known example of open systems we're using is the IBM PC hardware interface, which has been adapted by many manufacturers to create the familiar PC clones that all run the same application software. Another example is the Lightweight Directory Access Protocol (LDAP), an open standards mechanism adaptable for many directory uses, including email addresses, telephone numbers, physical addresses, and directories for printers, scanners and computers. We've adapted LDAP for use in the District's email, security, and ERP directories.

Web-adaptable systems and platforms offer interoperability, scalability, and the easy, anywhere user access that District agencies and residents need and want. A major example of a web-adaptable technology we're implementing is Hansen Technologies, a backend system we used to develop both an online business licensing application for the Department of Consumer and Regulatory Affairs, and the District's Customer Care Request application, which permits residents to submit service requests via the Internet.

Generic, networked process servers are rapidly replacing individual computer operating systems for many functions. Networked servers are efficient, highly functional, and widespread. Most of these servers are available now, or will soon be, with clustered configurations as part of the standard package. Clustered networks permit many separate devices and processes to work together as a virtual single unit, reducing management time and costs. Clustered networks provide multiple layers of protection against system failures. Today's clustered systems also maximize efficiency, because they allow system administrators to add and delete separate computer nodes as needed, tailoring the level of resources used to the size and complexity of particular tasks.

The District has strong needs to link now-separate functions, maximize efficiency, minimize IT costs, and protect against system failures. Clustered networks represent a highly workable choice for the city. Examples of clustered network technology in use in the District include the citywide email system and our web server. The email system incorporates a clustered configuration to provide failover protection—the ability to respond effectively to an unexpected hardware or

software failure. The web server uses clustering to provide failover protection, as well as load balancing (distribution of processing and communications functions evenly over network computers so that no single device becomes overwhelmed) and fault tolerance (the ability to continue operating in the event of interruptions such as power failures).

Integrated Computing Environments

We have two non-exclusive options for structuring the District's data processing environment—centralized mainframes and decentralized servers.

Centralized mainframes were the earliest form of processing environment, and they continue to offer significant performance benefits. A single, centralized mainframe can run many varied applications and is supported by a sophisticated system management structure including configuration management, problem management, change management, capacity management, security, and disaster recovery. Decentralized server platforms evolved when computer hardware costs decreased dramatically in the 1980s. Initially, decentralized servers were designed to support only a single application, and, for single-application use, afforded significant cost advantages over multi-functional centralized mainframes. Hardware costs were lower, and single application servers did not require the extensive system management structure needed for a centralized processing environment running multiple applications.

During the 1980s and 1990s, the District relied extensively on decentralized servers housed in individual agencies. As long as each server supported a single application, this approach provided all the cost advantages of decentralized servers without significant performance drawbacks. However, over time, performance declined as agencies began adding applications requiring servers designed for single applications to support several. In addition, decentralized servers did not meet the city's growing needs for interagency data sharing.

Meanwhile, the previously distinct centralized mainframe and decentralized server processing environments began to converge. Today, mainframes come equipped with multiple logical partitions that support multiple separate applications without affecting the entire mainframe. Decentralized servers also have multiple logical partitions to support more than one application. Storage area networks now permit the sharing and storage of data across many different server platforms. Networks can connect decentralized servers and centralized mainframes to permit high-speed communications and computing regardless of the location of the computing platform. Most significantly, the widespread connectivity provided by the Internet now supports virtually all types of computing functions, no matter where the end user or the computing platform is located.

In the District, we need systems that support interagency communications, data sharing, data storage and coordinated functions. We also need systems that are readily available, consistently reliable, and well-protected from intrusion and unau-

thorized use. OCTO is taking advantage of the convergence of centralized and decentralized processing environments to meet these needs. We're integrating mainframe and server platforms, linking these platforms with high-speed networks, and implementing, across both platform environments, the full array of system management functions needed to assure that District systems are available, reliable, maintainable, and secure.

Accessible, Secure Communications

District agencies need accessible communication systems, coordinated functions, and shared data to make services and information readily available to residents, businesses and visitors. However, highly accessible systems can be highly vulnerable to viruses and intrusion. As we make our systems more accessible, we must strengthen and expand our security protections. District communications projects will focus on our twin needs for greater access and stronger security protections, using a variety of technologies.

The District can enhance the accessibility of its communications systems by expanding the existing District wide area network (WAN) to all government locations, and by using new technologies, like wireless, to simplify and speed access. The emerging wireless communication technologies OCTO is considering for the District include:

- personal digital devices, including cell phones, pagers, personal messaging units, and personal digital assistants;

- portable cell modems that link personal computers to the Internet via wireless; and

- wireless workstations, which offer cost-effective alternatives for retrofitting or adding new physical network connections.

To ensure adequate IT security for the District, especially as we expand access to technology and communications, we must treat security as more than just protection of the systems themselves. Our approach views IT security as comprehensive management of the risks potentially associated with IT solutions. In the District, IT risk management serves a variety of objectives: protecting the confidentiality of personal and financial data; preventing misuse and inappropriate disclosure of sensitive operational data; avoiding system interruptions; maintaining residents' confidence in the reliability of city services; preventing fraud, waste and misuse of the District's computers, networks and data; and avoiding liability for tampering and illegal acts by third parties. To meet these objectives and manage IT-related risk efficiently and effectively, OCTO follows five principles:

- designate a central IT risk manager to design and maintain a citywide system of IT security;

- match security controls to related business necessities;

- implement security policies and procedures as well as technical controls;

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- promote awareness of security goals and procedures among all District employees; and

- continually monitor and re-evaluate the effectiveness of, and specific needs for, our policies, procedures, and controls.

We've selected a group of technologies to serve as the cornerstone of our security systems:

- PIN, a personal identification number that, along with a personal password, identifies an individual user for the purpose of access to PCs, the District's computing network, and some mainframe applications;

- SSL (secure socket layer), a protocol for transmitting private documents via the Internet using data encryption and a special connection;

- PKI (public key infrastructure), a system of digital certificates that verifies the identity and authority of all parties to an Internet transaction; and

- VPN (virtual private network) mechanisms, including encryption and others, to ensure that users can access District resources securely across a network.

7. Use Proven IT Best Practices

In exercising its responsibility to select IT technologies for the District, OCTO follows three principles based on industry best practices:

- proven technologies
- adaptable products
- outsourced commodity IT services

Proven Technologies

In selecting technologies for the District, we have the choice of stable, proven technologies or new, bleeding edge solutions. Bleeding edge technologies offer exciting, innovative solutions, but they are risky. A bleeding edge technology may never be fully developed, because it may not win wide acceptance in the marketplace. Bleeding edge solutions also squeeze IT personnel, budget and technical resources. They sometimes require longer implementation cycles, and they demand ready adaptation to change as well as considerable skill in dealing with the technologies as they mature. Proven technologies, on the other hand, are more reliable, and are better understood by IT personnel and end-users. In the District, we're implementing urgent IT solutions with limited personnel, budgets, and time. We can't afford the risk of bleeding edge solutions. Proven technologies represent our most workable choices. Examples of the proven technologies we're implementing include:

- Windows 2000 (proven) vs. XP (bleeding edge) for workstation operating software,

- text (proven) vs. streaming audio, video or virtual reality (bleeding edge) for web pages, and

- standard email (proven) vs. instant messaging (bleeding edge) for communications between District employees.

Adaptable Products

The District is rebuilding an outdated IT infrastructure, revamping and replacing numerous systems. We need technology products that readily accommodate these changes. Adaptable technologies accommodate change. They facilitate functional enhancement, scalability, integration with other systems and technologies, and minimally disruptive user upgrades.

The most important proof of adaptability is whether a system conforms to open, rather than proprietary, architecture standards. Open standards offer proven technology, known performance characteristics and well-understood tuning parameters. Open standards products also allow us to develop technology solutions with commercial off-the-shelf (COTS) components instead of building new systems from scratch. In addition, adaptable open standards products eliminate the need to stock up in anticipation of projected growth. With adaptable products, we can upgrade and enhance our IT systems as needs arise. An example of the adaptable products we're using is the LDAP protocol that's adaptable for numerous directory purposes including citywide email, ERP, and security.

Outsourced Commodity IT Services

For some technology services, those that are least differentiated and most commodity-like, outsourcing is a very workable solution. Centralized outsourcing of commodity IT services can yield significant cost savings through volume discounts. More importantly, outsourcing can free District IT personnel to focus on promising IT programs that advance our true mission—serving residents and businesses. However, outsourcing is most efficient for services that are managed centrally, and is effective only where the outsourcing organization has experienced IT personnel capable of managing outsourcing activities.

For these reasons, we're approaching outsourcing in a two-phased process that internally centralizes commodity-like services first and then outsources these centralized services. In addition, we're outsourcing only in situations where we have a strong District IT professional to manage the outsourced services.

Leading candidates for outsourcing are certain security services, including digital certifications and intrusion detection, selected electronic services delivered through the District's web portal, and seat management (procurement and maintenance for PC workstations). Currently we're evaluating outsourcing for security services, we've pilot-tested outsourcing of electronic services with a business license registration application, and we've launched a project to outsource PC seat management.